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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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EXAMINER

ART UNIT	PAPER NUMBER
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DATE MAILED:

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.

09/633,598

Applicant(s)

REDWING ET AL.

Examiner

Wai-Sing Louie

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED. (35 U.S.C. § 133)
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-10 is/are pending in the application.
- 4a) Of the above claim(s) 10 is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-9 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2
- 4) ☒ Interview Summary (PTO-413) Paper No(s) 2
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other

DETAILED ACTION

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:
 - I. Claims 1-9, drawn to semiconductor device, classified in class 257, subclass 20.
 - II. Claim 10, drawn to method of fabricating the semiconductor device, classified in class 438, subclass 172.

The inventions are distinct, each from the other because of the following reasons:

Inventions Group I and Group II are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case, forming a HEMT device with an InGaN channel, it would be possible to form a heterostructure LED device with an InGaN channel.

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

During a telephone conversation with Robert McLauchlant on 8/16/01 a provisional election was made without traverse to prosecute the invention of Group I, claims 1-9. Affirmation of this election must be made by applicant in replying to this Office action. Claim 10 is withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the

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currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a petition under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 9 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 9, line 2, it is unclear what is meant by "increasing the sheet density"?

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1 and 2 are rejected under 35 U.S.C. 102(b) as being anticipated by Maeda et al. (JP 11-274474).

With regard to claim 1, Maeda et al. disclose a gallium nitride-based HEMT device (page 1-5), comprising a channel layer formed of an InGaN alloy (page 3, line 10).

With regard to claim 2, Maeda et al. disclose an AlGa_N/InGa_N heterostructure (page 3, line 9 and page 5, paragraph 0012).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 3, 6, and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Maeda et al. (JP 11-274474) in view of Nagahama et al. (US 6,172,382).

With regard to claim 3, Maeda et al. do not disclose the semiconductor device comprising a Ga_N layer, an InGa_N layer over the Ga_N layer, and an AlGa_N layer over the InGa_N layer. However, Nagahama et al. disclose a Ga_N layer, an InGa_N layer over the Ga_N layer, and an AlGa_N layer over the InGa_N layer (Nagahama col. 19, line 31, col. 20, line 67, col. 21, line 18 and fig. 2). Nagahama et al. teach the AlGa_N layer has higher band gap energy than the active layer, InGa_N and making it possible to decrease the threshold voltage (Nagahama col. 17, lines 18-22 and lines 40-42). Therefore, it would have been obvious to one with ordinary skill in the art to provide a structure mentioned above in order to have higher band gap energy and decrease the threshold voltage.

With regard to claim 6, Maeda et al. do not disclose the device is an InGa_N/InGa_N HEMT. However, Nagahama et al. disclose the device comprises an InGa_N/InGa_N multiple quantum well (MQW) layer (Nagahama col. 21, lines 56-63). Nagahama et al. teach the

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InGaN/InGaN MQW may have a doped InGaN barrier layer which reduce the threshold value (Nagahama col. 21, lines 65-66) and the InGaN/InGaN MQW has a lower band gap energy (Nagahama col. 22, lines 2-3). Therefore, it would have been obvious at the time the invention was made to provide an InGaN/InGaN MQW in Maeda's device to form an InGaN/InGaN HEMT in order to lower the threshold value for the device.

With regard to claim 9, Maeda et al. do not disclose the AlGaN layer is doped with dopant. However, Nagahama et al. disclose an n-doped AlGaN cladding layer (Nagahama col. 21, line 18). Nagahama et al. teach the n-AlGaN cladding layer functions as a carrier-trapping layer and this layer can be formed to a good quality crystal without cracks (Nagahama col. 21, lines 18-34). Hence, it would have been obvious to one with ordinary skill in the art to provide a doped n-AlGaN layer in Maeda's device in order to provide a carrier supply layer.

Claims 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Maeda et al. (JP 11-274474) in view of Yoshida (JP 11-261053).

With regard to claims 4 and 5, Maeda et al. do not disclose a HEMT device contains no aluminum in the material. However, Yoshida disclose a GaN/InGaN HEMT that contains no aluminum in the material of each layer (Yoshida page 3, paragraph 0014 and abstract). Yoshida teaches AlGaN has higher band gap energy than InGaN and GaN. If AlGaN is used in the HEMT structure, mismatches amount the layers could be developed (Yoshida page 1, paragraph 0005 and page 2, paragraph 0013). Hence, it would have been obvious to one with ordinary skill in the art to eliminate aluminum in all the layers to have a GaN/InGaN HEMT in order to avoid the mismatch in the device.

Claims 7 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Maeda et al. (JP 11-274474) in view of Kawai et al. (US 5,929,467).

With regard to claims 7 and 8, Maeda et al. disclose an AlGa_N layer (page 2, paragraph 0005), but do not disclose whether it is doped or undoped. However, Kawai et al. disclose an intrinsic AlGa_N layer (Kawai col. 7, line 22). Kawai et al. teach this layer acts as a barrier layer adjacent to the active layer (Kawai col. 7, line 31). This layer could inhibit the short channel effect and stabilize the constant-current leakage in the region (Kawai col. 7, lines 53-56). Hence, it would have been obvious to one with ordinary skill in the art to provide an intrinsic (undoped) AlGa_N layer in Maeda in order to minimize the short channel effect.

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5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Wai-Sing Louie whose telephone number is (703) 305-0474. The examiner can normally be reached on 7:30 AM to 4:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on (703) 306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

wsf

August 23, 2001



OLIK CHAUDHURI
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